Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

Research Note

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION
OGDEN UTAH

.9
764Un
p.2

U.S. Forest Service
Research Note INT-66 1967

EFFECT OF PARTIAL CUTTING IN OVERMATURE LODGEPOLE PINE

Charles R. Hatch[1]

ABSTRACT

Reports 11-year observations of a partially cut 120- to 160-year-old lodgepole pine stand in western Montana. Heavy mortality following partial cutting caused a yearly net growth rate of −53 cubic feet per acre. Mortality remained relatively uniform on an annual basis over the 11-year period. Adequate regeneration followed cutting although the overstory rapidly infected the stand with dwarfmistletoe.

Partial cutting of lodgepole pine (*Pinus contorta* Dougl.) stands was generally accepted and widely practiced in Montana prior to 1946. With the advent of large-scale pulpwood cutting in old-growth stands, selective forms of cutting were gradually abandoned in favor of clearcutting. Whether clearcutting or selective cutting was a more suitable practice from the standpoint of regeneration and ultimate yield became highly conjectural. Because of uncertainty, a series of observational plots was established[2] in a partially cut stand in western Montana. The objectives were (1) to measure growth response and mortality of the residual stand, and (2) to determine the amount of natural regeneration following partial cutting.

---

[1] Assistant Silviculturist, who is headquartered in Bozeman, Montana, at the Forestry Sciences Laboratory, which is maintained in cooperation with the Montana State University.

[2] R. K. LeBarron established the study; K. N. Boe collected 6th-year measurement data; David Tackle collected 11th-year measurement data and initiated data analysis. All were research foresters formerly assigned to this study.

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY
NOV [illegible]
CURRENT SERIAL RECORDS

Eleven-year records now attest the soundness of early decisions to clearcut overmature, heavily mistletoed lodgepole pine stands. This paper supports other observational and experimental evidence weighing heavily against partial cutting in low vigor, old-growth stands (Alexander 1954, 1966; Blyth 1957; Hornibrook 1940; LeBarron 1952; Mowat 1949).

STUDY AREA

The study area is located on north- and south-facing exposures at an elevation of 6,600 feet in the Moser Creek drainage of the Gallatin National Forest, Montana. Slope gradients were gentle to moderate--10 to 20 percent--on terrain of average site quality. The plots were established in a pure, overmature stand of lodgepole pine 120 to 160 years of age. Prior to cutting in 1947, the stand had a volume of 4,370 cubic feet per acre.

The vigor of the stand averaged C-minus, according to Taylor's (1937, 1939) tree classification system. The stand had suffered heavy mortality during the past 20 years and nearly 100 percent of the trees and saplings were infected with dwarfmistletoe (*Arceuthobium americanum*). However, the dwarfmistletoe had not caused excessive brooming.

Before logging, reproduction averaged 2,920 trees per acre on the north slope and 160 trees per acre on the south slope. More than 50 percent of the seedlings and saplings were lodgepole pine. Engelmann spruce (*Picea engelmanni*), Douglas-fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*), and subalpine fir (*Abies lasiocarpa*) were also present. Principal understory vegetation on the area included grouse whortleberry (*Vaccinium scoparium*), snowberry (*Symphoricarpos* spp.), pinegrass (*Calamagrostis rubescens*), arnica (*Arnica* spp.), and beadlily (*Clintonia* spp.)

METHODS

Five circular, tenth-acre plots were installed on each aspect. On each plot, all trees 0.5-inch d.b.h. and larger were recorded by location, species, 1-inch diameter class, and amount of dwarfmistletoe infection. Dwarfmistletoe infection was subjectively placed into one of four classes: none, light, medium, or heavy. Lodgepole pine 5 inches d.b.h. and larger were rated using Taylor's tree classification system, and volumes were computed for all species. Harvested trees, trees destroyed by logging, and residual trees were located and tallied immediately following logging. The plots were remeasured in 1953 and 1957.

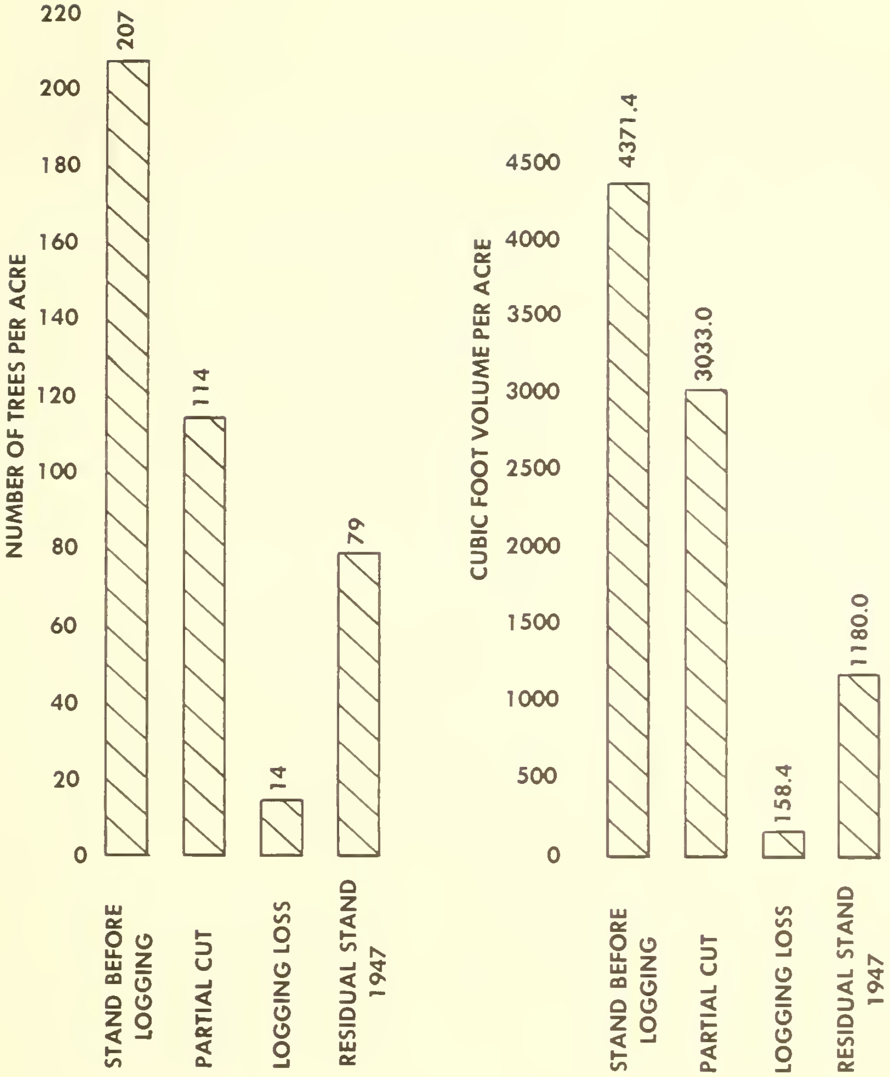

Figure 1.--Changes in the stand following partial cutting in 1947, all trees 5 inches d.b.h. and larger.

Thrifty trees and trees of the size and quality for transmission line poles were marked as "leave" trees. The selective cut removed 69 percent of the volume. Logging losses reduced the volume by an additional 4 percent. Figure 1 shows the changes that occurred in the stand during partial cutting in 1947.

Regeneration density and stocking were measured at each plot by using a transect of 10 square-milacre quadrats. On each quadrat, all trees less than 0.5-inch d.b.h. were recorded by species and 1-foot height class. Reproduction quadrat recordings were made before logging in 1947 and during plot remeasurement in 1953 and 1957.

RESULTS

Periodic annual gross increment was only 14 cubic feet per acre during the first measurement period. Ingrowth contributed nearly one-quarter of the gross growth. Gross growth did not increase substantially during the last 5 years[3] of measurement (table 1). Mortality was four times greater than gross increment during the 11-year period. By 1957, the residual stand volume had been reduced 49 percent (fig. 2).

Wind was responsible for over one-half of the mortality. Periodic annual mortality during both measurement periods was approximately the same (table 2).

Six years after logging, the north and south slopes were 78 and 34 percent stocked, respectively. Stocking increased slowly and at about the same rate during the second measurement period (table 3).

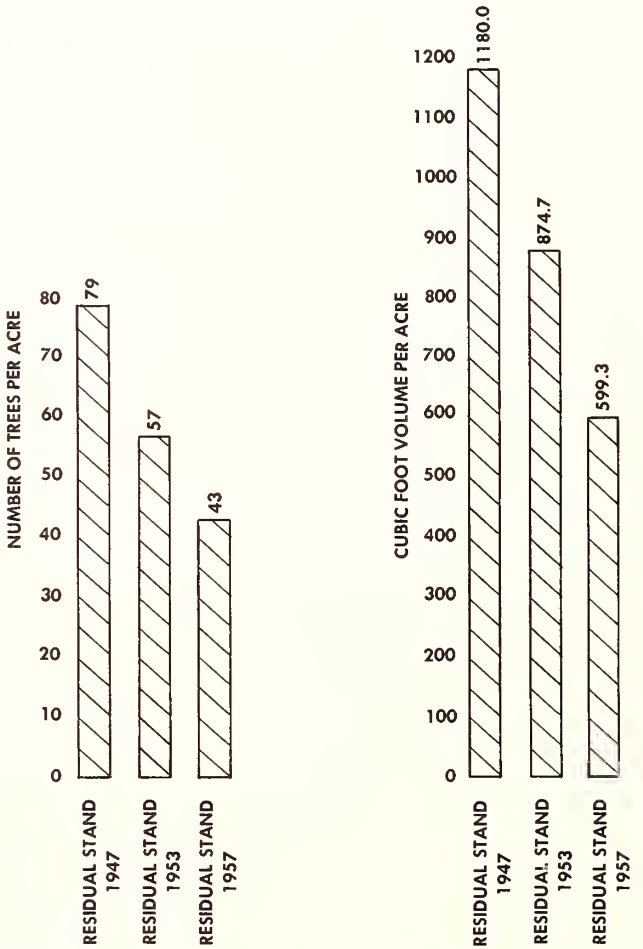

Figure 2.--Growth of residual stand following partial cutting in 1947, all trees 5 inches d.b.h. and larger.

---

[3] The period of time was 4 years, but nearly five growing seasons were covered--May 1953 to August 1957.

Table 1.--Periodic annual increment and mortality, all trees 5 inches d.b.h. and larger

Period	Ingrowth	Gross increment	Mortality	Net increment
	Number of trees per acre			
First 6 years	1	1	5	-4
Last 5 years	1	1	4	-3
11-year period	1	1	4	-3
	Cubic foot volume per acre			
First 6 years	3.2	14.2	65.1	-50.9
Last 5 years	3.9	19.5	74.6	-55.1
11-year period	3.5	16.6	69.4	-52.8

Table 2.--Periodic annual mortality by cause, all trees 5 inches d.b.h. and larger

Cause	First 6 years 1947-1953	Last 5 years 1953-1957	11-year period 1947-1957
	Number of trees		
Wind	3	2	2
Other[1]	2	2	2
Total	5	4	4
	Cubic foot volume		
Wind	47.0	33.9	41.0
Other	18.1	40.7	28.4
Total	65.1	74.6	69.4

[1] Includes mortality due to trespass cutting and unknown factors.

Table 3.--Seedling distribution and density by aspect

Aspect	Seedling distribution						Seedling density	
	1947[1]		1953		1957		1957	
	LPP[2]	All species[3]	LPP	All species	LPP	All species	LPP	All species
	Percent stocked milacre quadrats						No. of trees/acre	
orth	50	70	68	78	74	84	4,240	5,100
outh	8	12	30	34	38	42	560	660

[1] Prior to logging.

[2] Lodgepole pine.

[3] Lodgepole pine, Engelmann spruce, Douglas-fir, limber pine, and subalpine fir.

DISCUSSION AND CONCLUSIONS

Too often, partial cutting was used as an interim practice, with clearcutting as a final objective. As market conditions changed, the terminal cut was never made. A heavily diseased stand of jumbled age classes was the final result. The final stand lacked adequate volume and value to justify an economical cut.

A severe partial cut, 69 percent of the original stand's cubic foot volume, contributed to the heavy loss of residual stand volume through mortality. Much of the unclassified mortality could probably be related to root damage and similar injury sustained during logging. After partial cutting, the stand went steadily downhill. Losses remained relatively uniform on an annual basis for the 11-year period.

Since no measure of stocking or ground scarification was made immediately following logging, stocking and seedbed conditions at that time are unknown. Advanced regeneration in even-aged old-growth lodgepole pine stands is seldom abundant or disease-free. If such stands are infected with dwarfmistletoe, clearcutting is desirable and should include the advanced regeneration.

Increased regeneration was noted on the area after 6 years. Although the north slope was overstocked and the south slope had the minimum allowable stocking in 1957, the diseased residual stand had begun to infect the reproduction with dwarfmistletoe.

Observations of the overmature stand indicated that a partial cut should not have been made. Chances for a successful partial cut are determined largely by the vigor of the residual stand, by the site, and by accessibility and market opportunities. Partial cutting in the lodgepole pine type should be made only for cultural benefits, such as thinning or sanitation.

LITERATURE CITED

Alexander, R. R.

1954. Mortality following partial cutting in virgin lodgepole pine. U.S. Forest Serv., Rocky Mountain Forest & Range Exp. Sta., Sta. Pap. 16, 9 pp.

______ 1966. Harvest cutting old-growth lodgepole pine in the central Rocky Mountains. J. Forest. 64: 113-116, illus.

Blyth, A. W.

1957. The effect of partial cutting in even-aged lodgepole pine stands. Can. Dep. N. Aff. & Nat. Resources, Forest. Br., Forest Res. Div. Tech. Note 61, 14 pp., illus.

Hornibrook, E. M.

1940. A preliminary yield table for selectively cut lodgepole pine stands. J. Forest. 38: 641-643.

LeBarron, R. K.

1952. Silvicultural practices for lodgepole pine in Montana. U.S. Forest Serv., Northern Rocky Mountain Forest & Range Exp. Sta., Sta. Pap. 33, 19 pp., illus.

Mowat, E. L.

1949. Preliminary guides for the management of lodgepole pine in Oregon and Washington. U.S. Forest Serv., Pacific Northwest Forest & Range Exp. Sta. Res. Note 54, 10 pp., illus.

Taylor, R. F.

1937. A tree classification for lodgepole pine in Colorado and Wyoming. J. Forest. 35: 868-875, illus.

______ 1939. The application of a tree classification in marking lodgepole pine for selection cutting. J. Forest. 37: 777-782, illus.

AFPS, Ogden, Utah

FOREST SERVICE CREED

The Forest Service of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's Forest Resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private owners, and management of the National Forests and National Grasslands, it strives — as directed by Congress — to provide increasingly greater service to a growing Nation.